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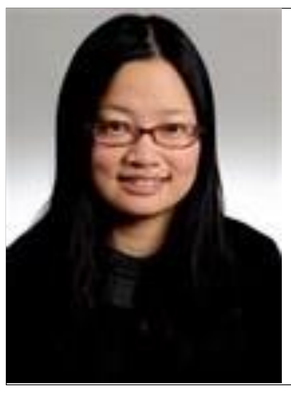

Integrating LCA and Risk Assessment for Decision Support

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Background

Picture is adapted from: http://www.chelseamassage.com.au/june-newsletter/

- The most sustainable solution may not be the safest one.
- Which solution should decision-makers choose?

Aim

- The study aims at developing a methodology using decision analysis theory and tools to find the optimal policy (or design) of the studied system, to ensure both sustainability and meanwhile manage risks.

Method

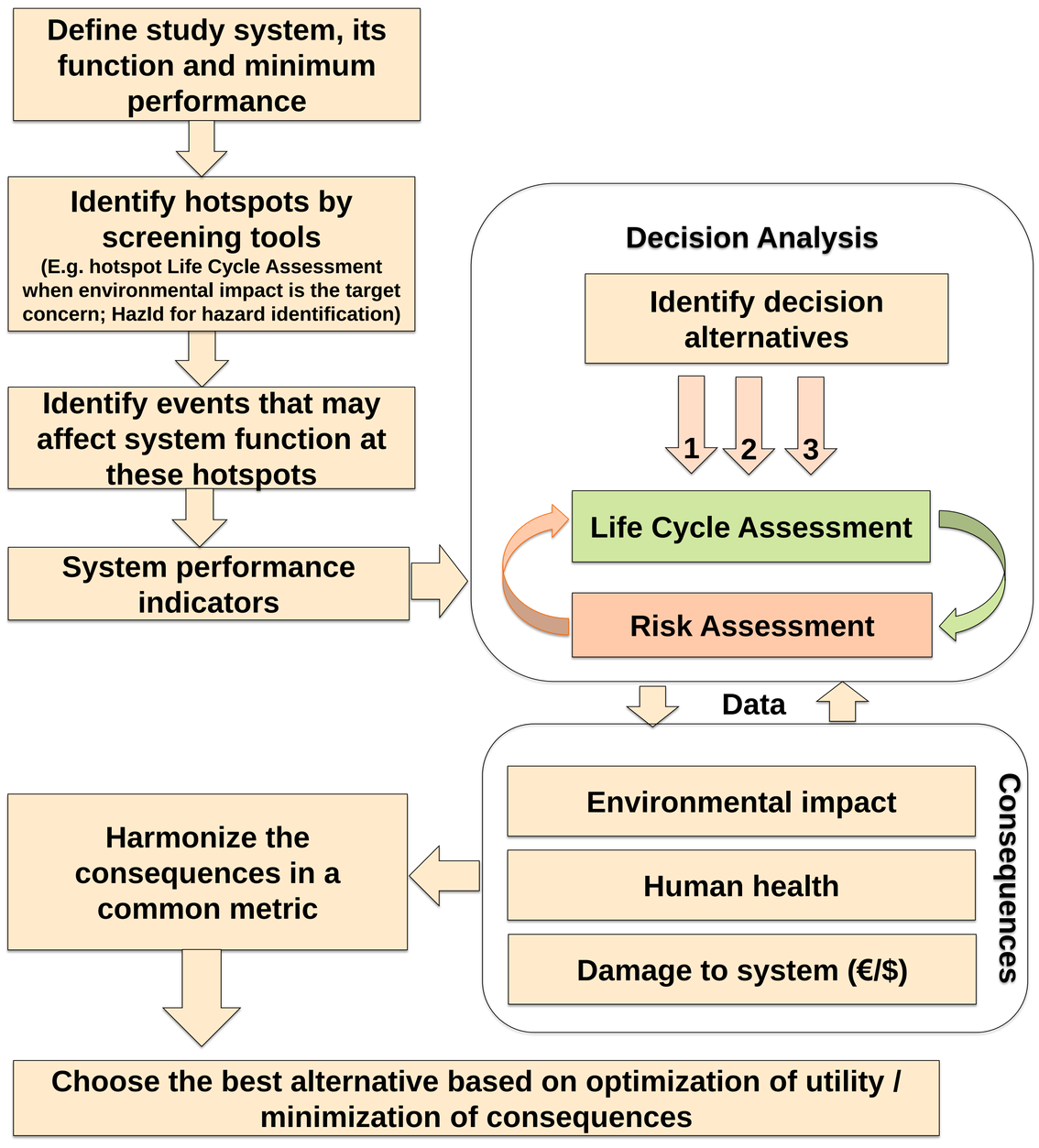

Figure 1. Decision Support for Integrating Life Cycle Assessment (LCA) and Risk Assessment.

Conclusions

- This framework is flexible. It can be applied to facilitate decision making in different application areas on different scales.
- It allows the use of different metrics for consequence harmonization according to stakeholders preference, qualitatively or quantitatively (e.g. Multi-Criteria Analysis, monetarized metrics)
- It provides decision makers with both sustainability and risks information related to their alternatives.

Application of the methodology

Urban Transportation System

- The purpose of the case study is to minimize risks in the Danish road system while maintaining low environmental impacts.
- We choose car accidents as the example of events that affect the function of the system.
- Screening by database and models, there are some certain locations where significantly more car accidents happen. These locations are identified as hotspots.
- The system performance changes and the effects on traffic can be simulated through the Danish National Transport Model (NTM).
- Propagation of the risk of accidents throughout the road network adjacent to the accident location is not included (only congestion is considered as follow-up event) .

Figure 2 shows the cause-effect interaction among events, alternatives and consequences.

- Car accident and potential road block (cascading event) can be assessed by Probabilistic Risk Assessment.
- Environmental impacts can be assessed by Life Cycle Assessment.
- Economical benefits/losses can be assessed by Cost Benefit Analysis
- The consequences can be harmonized in a common metrics.
- Cost-benefit analysis coupled with Decision Analysis Optimization is used to rank the alternatives.
- Probability and uncertainty is included in every step.

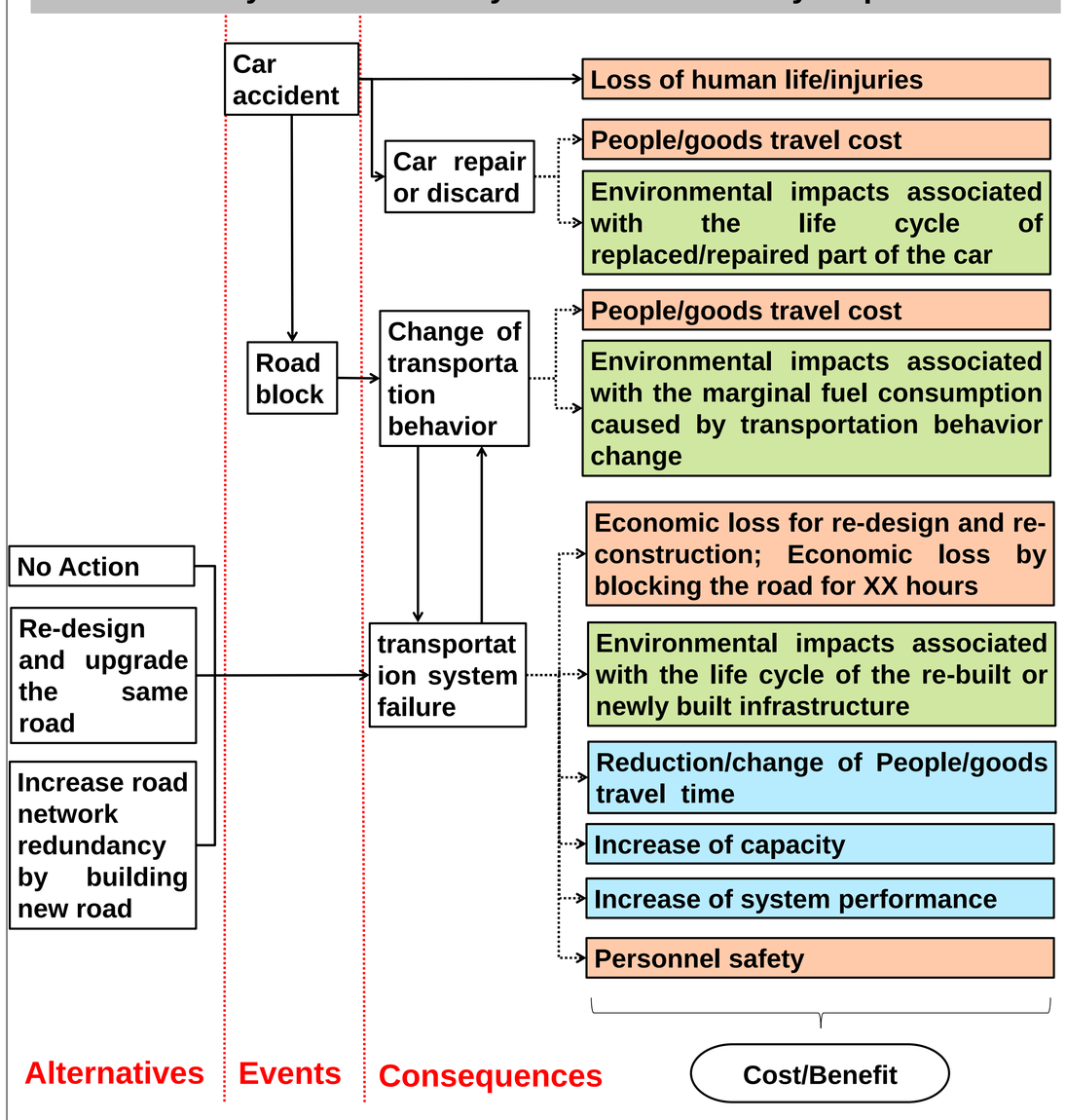

Figure 2. Application example of the methodology on urban transportation system design. Pink boxes are economic loss. Green boxes are environmental impacts. Blue boxes are economical benefits. Solid lines with arrow indicate "cause-effect" relationships. Dotted arrows point from the events to potential impacts.

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